

Piecewise-Local Expression Builder

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These slides describe PLEB,
a component of the Language Toolkit

- Written in Haskell
- Is not Haskell
- `https://github.com/vvulpes0/Language-Toolkit-2/tree/develop`
- Expressions very slightly simplified here

Substring Containment

Syntax	Semantics
$\langle F \rangle$	contains $\llbracket F \rrbracket$ as a substring
$\bowtie \langle F \rangle$	contains $\llbracket F \rrbracket$ as a prefix
$\bowtie \langle F \rangle$	contains $\llbracket F \rrbracket$ as a suffix
$\bowtie \bowtie \langle F \rangle$	the set containing only $\llbracket F \rrbracket$

The factor F is a space-separated sequence of symbols:

$$\bowtie \bowtie \langle a \ b \ c \rangle = \{abc\}$$

The fish (\bowtie and \bowtie) are anchors,
pinning the factor to the indicated side of the string

Substring Containment — Exercises

- 1 How would we represent $\{abba\}$?
- 2 Name three strings in the language $\langle a b \rangle$ if the alphabet is $\Sigma = \{a, b, c\}$
- 3 What formal language is represented by $\langle \rangle$?

Some Operations

Syntax	Semantics
$\neg x$	$\Sigma^* - \llbracket x \rrbracket$
$\bullet S$	concatenate all elements of $\llbracket S \rrbracket$, in order
$\bigwedge S$	intersect all elements of $\llbracket S \rrbracket$
$\bigvee S$	union all elements of $\llbracket S \rrbracket$

x is a PL-expression.

S is a comma-separated sequence of PL-expressions enclosed in braces or parentheses:

$$\bigwedge \{ \langle a b \rangle, \langle b a \rangle \}$$

means “contains ab and contains ba”.

Some Operations — Exercises

- 1 What language does the following represent:
 $\neg \bigvee \{ \langle a a \rangle, \langle b b \rangle \}$
- 2 Explain how Star Free Expressions
can be rewritten as PL-expressions

Piecewise Factors

Local:	$\langle a\ b\ c \rangle$
Piecewise:	$\langle a, b, c \rangle$

Local factor: these symbols appear in order, adjacently

Piecewise factor: these symbols appear in order

For example: “**a**utomaton**n**” satisfies $\langle a, n \rangle$.

Fish work too: $\times \langle a, b \rangle$

means “starts with an **a** and contains a **b** later”

Piecewise Factors — Exercise

- 1 Show that piecewise factors are redundant.

A Few Final Operations

Syntax	Semantics
$*X$	$\llbracket X \rrbracket^*$
$\downarrow x$	words in $\llbracket x \rrbracket$ with zero or more characters deleted
$[T]x$	$\llbracket x \rrbracket$ applies on the T tier

x is a PL-expression

T is a comma-separated list of symbols

$[a, b] \neg \langle a \ a \rangle$ means

“when looking only at **a** and **b**, no two **a** appear together”:

“sacc**a**de” is forbidden, but

“cab**b**a**a**ge” is acceptable.

ASCII Syntax

Unicode	ASCII
$\langle \rangle$	$\langle \rangle$
\times	%
\times	%
\neg	!
\neg	~
\wedge	\wedge
\vee	\vee
•	@
\downarrow	\$

Final Exercise

- 1 Show the equivalence of Regular Expressions and PL-expressions.